

SERUM CHOLESTEROL IN
AMBULATORY INDIVIDUALS WITH
CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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An Abstract of a Thesis by

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The problem.

Current accepted therapeutic modality in dietary management for individuals with chronic obstructive pulmonary disease (COPD) includes 40-50% of the caloric intake to come from fat sources. According to current literature, diets high in fat lead to elevated total serum cholesterol levels and increased risk for the development of coronary heart disease. Little research has addressed the incidence and associated risk of elevated total serum cholesterol levels because of diet therapy in ambulatory individuals with COPD.

Procedure.

Records of 46 persons with COPD who participated in a pulmonary rehabilitation program at a midwestern medical center between the years of 1986-1989 were reviewed for total serum cholesterol level, severity of disease, age, gender, and smoking history.

Findings.

Although mean total serum cholesterol levels evaluated were elevated >200 mg/dl, the level set by the American Heart Association, there was no significant difference in total serum cholesterol level when the sample was categorized by severity of disease, age, and gender. Additional findings indicated 83% of the sample had smoked. Female subjects smoked more packs per day for a slightly longer period of time than did the males.

Conclusions.

While hypotheses of the study were not supported, increased total serum cholesterol levels in 76% of the subjects was a finding that has implications for the practice of nurses who work with ambulatory individuals with COPD.

Recommendations.

Replication of the study with a larger sample size and inclusion of a larger number of variables were suggested. Additional recommendations were given.

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CHAPTER I

DIMENSIONS OF THE PROBLEM

The purpose of this study was to investigate whether there was a difference in total serum cholesterol level as a function of severity of disease, age, and gender in ambulatory individuals with chronic obstructive pulmonary disease (COPD).

Disease progression in COPD is commonly accompanied by weight loss and muscle wasting. Dietary fat consumption has been encouraged by health care providers to lessen carbon dioxide production which is a normal by-product of carbohydrate metabolism during energy production and utilization (Openbrier & Covey, 1987).

Most nutritional studies have been directed at exploring optimal nutrition for those individuals with chronic lung disease who are also suffering from acute respiratory failure. Studies have discussed nutritional needs of critically ill adults in conjunction with protocol for successful weaning from mechanical ventilation (Asmundsson & Kilburn, 1969; Askanazi, Rosenbaum, Hyman, Silverberg, Milic-Emili, & Kinney, 1980; Weissman & Hyman, 1987; Schlichtig & Sargent, 1990). A higher fat diet is the accepted choice for nutritional therapy in this situation because of the relatively high caloric value per gram of fat. In addition, little, if any, change in the respiratory quotient (RQ) results from replacement or

feeding from fat in this group (Askanazi, Rosenbaum, & Hyman, 1980; Covelli, Black, Olson, & Beekman, 1981; Angelillo, Bedi, Durfee, Dahl, Patterson, & O'Donohue, 1985; Keim, Luby, Braun, Martin, & Dixon, 1986).

On the other hand, nutritional counseling for the stable COPD individual has not been addressed. Limited literature is available that addresses the nutritional needs of ambulatory individuals with COPD. Few research studies have addressed ramifications of high fat diet in this population, whereas the literature abounds with information regarding the effects of fat in the "typical" American diet (Angelillo, Bedi, Durfee, Dahl, Patterson, & O'Donohue, 1985; Becker & Wilder, 1987).

Evidence of the importance of elevated serum cholesterol in the pathogenesis of coronary artery disease has been well documented (Shekelle, Shyrock, Paul, Lepper, Stamler, Liu, & Raynor, 1981). An estimated 60% of all United States adults aged 20 to 74 years are reported to have an elevated total serum cholesterol level equal to or greater than 200 mg/dL. Survey data from this same twenty year national survey have revealed a fall in incidence of coronary heart disease and its associated fatal events. The study correlates this phenomenon with changes in the American diet, i.e., limitation of fats, as one reason for the reduction in cholesterol level and the incidence and mortality from coronary heart disease (Fulwood, Kalsbeek,

Rifkind, Russel-Briefel, Muesing, LaRosa, & Lippel 1986). However, cardiovascular disease remains the leading cause of death in the United States, accounting for approximately 45% of deaths from all causes (American Heart Association, Iowa Affiliate, 1989).

Effectiveness in the use of a higher fat diet when weaning acutely ill adults from mechanical ventilation has prompted the general acceptance and use of client education protocols aimed at encouraging ambulatory individuals with COPD to consume a diet higher in fat (Openbrier & Covey, 1987). In light of what is known regarding fat consumption, the relationship of elevated total serum cholesterol level and implications for the development of coronary heart disease and associated fatal events, it seems reasonable to question the validity of continuing to educate and counsel ambulatory individuals with COPD in this manner.

Literature associated with lipids (cholesterol and triglycerides) and lung disease is limited. It is not enough to address serum cholesterol levels in conjunction with the administration and use of commonly prescribed pharmacological preparations for the treatment of COPD (Jefferys, Lessof & Mattock, 1980; Tisi, Conrique, Barrett-Connor, & Grundy, 1981; Lehtonen, Viikari, Sallinen, & Elo, 1982; Bolton, Mulloy, Harvey, Downs, & Hartog, 1989). The potential problem(s) of appropriate

dietary management and the ramifications of a high fat diet have not been adequately addressed for the ambulatory portion of the COPD population. There is a distinction between the nutritional needs of the individual with stable COPD and the individual who is acutely ill (Openbrier & Covey, 1987).

Purpose of the Study

The purpose of this study was to investigate whether there was a difference in total serum cholesterol level as a function of severity of disease, age, and gender in ambulatory individuals with COPD.

Hypotheses

The three following hypotheses were tested:

1. There will be a difference in total serum cholesterol level when the sample is categorized by severity of disease. Rationale: current nutritional modalities for those with COPD include consumption of high fat diets (Openbrier & Covey, 1987).
2. There will be a difference in total serum cholesterol level when the sample is categorized by age. Rationale: Prevalence for elevated total serum cholesterol rises with age to plateau at approximately 50 years of age, except in older women (NCEP, 1988).
3. There will be a difference in total serum cholesterol level when the sample is categorized by gender. Rationale: male gender is considered a risk

factor for the development of coronary heart disease (NCEP, 1988).

Definition of Terms

The following definitions were used:

Total Serum Cholesterol Level

Total serum cholesterol is distributed in a lipoprotein complex and includes the sum total of the following : High Density Lipoproteins (HDL), Low Density Lipoproteins (LDL), and Very Low Density Lipoproteins (VLDL). An elevated total serum cholesterol level is associated with increased risk for the development of atherosclerotic disease processes, in particular, coronary heart disease (CHD). It is represented as a numeric value. The current recommended value of equal to or less than 200 mg/dL was the point for evaluation in relationship to levels elevated in those with COPD. Levels greater than 200 mg/dL were considered to represent individuals at risk (NCEP, 1988).

Severity of Disease

The degree of severity in lung disease is quantified in part by ratio proportions set by the Intermountain Thoracic Society (Kanner & Morris, 1975). The following ratios reflect forced expiratory volume in one second (FEV1) compared to forced vital capacity (FVC), are expressed in liters/second, and are determined by pulmonary function testing.

Degree of Severity	FEV1/FVC
Normal.....	>0.69 l/sec
"Mild".....	0.61-0.69 l/sec
"Moderate".....	0.45-0.60 l/sec
"Severe".....	<0.45 l/sec

FEV1

The amount of forced expiratory air moved in one second following deep inspiration, expressed in cc/second.

FVC

The total amount of forced expiratory air moved following deep inspiration, expressed in cc/second.

Ambulatory Individuals

Ambulatory individuals refer to those able to carry out normal activities of daily living with minimal restriction, e.g., being able to walk independently and not confined to bed. These individuals are considered stable although they may require acute medical intervention on an episodic basis.

Chronic Obstructive Pulmonary Disease (COPD)

This medical disease category is composed of the following three diseases: chronic bronchitis, bronchial asthma, and emphysema. This category is characterized by resistance to expiration of air from the lungs. Chronic obstructive pulmonary disease may also be referred to as chronic airflow limitation (CAL) or

chronic obstructive lung disease (COLD).

Theoretical Basis of the Study

Dorothy Johnson's Behavioral System Model served as the theoretical basis for this retrospective, comparative study. Individuals as behavioral systems are made up of seven subsystems. Each subsystem is responsible for performing specific task for the system as a whole. The system as a whole operates at some level of efficiency and effectiveness in order to maintain overall equilibrium and dynamic stability (Johnson, 1980).

Nursing problems, actual or potential, arise from system or subsystem disequilibrium or because there is a less than optimal or non-constructive change in behavioral functioning. Actual nursing problems indicate the need for certain nursing actions. Potential nursing problems may indicate the need for preventive nursing action. The goal of nursing action is to restore, maintain, or attain behavioral system equilibrium and stability at the highest possible level for the individual (Johnson, 1980).

Nursing serves as an external regulatory force which acts to preserve the equilibrium and stability of an individual. Nursing service is needed when there is actual system disequilibrium resulting in illness or there is a threat to an individual's social or physical health. The nurse functions to assist the client in achieving optimal behavioral functioning by imposing external control

mechanisms, through attempts to change structural units in constructive directions, or through meeting the functional requirements of the system (Johnson, 1980). As a result of these nursing services, the individual will achieve and maintain a degree of stability and equilibrium as evidenced by patterns of constructive functioning or behavior (Johnson, 1961; 1968; 1974; 1978a; 1978b; 1980; Wallace & Coberg, 1988).

Johnson identifies five major causes of instability or problems within the system as:

1. Inadequate or inappropriate development of the system or its parts;
2. Breakdown in internal regulatory or control mechanisms;
3. Exposure to noxious influences;
4. Inadequate stimulation of the system; and
5. Lack of adequate environmental input (Johnson, 1978b).

Within the framework of this study, Johnson's theory was interpreted to substantiate the following premises.

1. Current dietary management for COPD includes ingestion of a higher percentage of fat than would otherwise be considered to be "heart healthy". Lack of research in dietary management of the ambulatory individual with COPD may then contribute to an inappropriate development of the system or its parts.

2. Higher total serum cholesterol levels in this population may be reflective of increased consumption of higher fat diets in ambulatory individuals with COPD. This would contribute to a breakdown in internal regulatory or control mechanisms.

3. Based on research data which indicates a strong correlation between elevated total serum cholesterol and associated health risks, the ingestion of a higher fat diet by ambulatory individuals with COPD may be considered to be an exposure to a noxious influence.

4. Inadequate stimulation of the system is evident in the following way: reduction of calories from saturated fat and not increased consumption in the ingestion of cholesterol-containing foods is first-line therapy in the treatment of elevated serum cholesterol. Exercise, another effort aimed at successful management, is not generally prescribed for ambulatory individuals with COPD because they are not tolerant of or conditioned for the activity.

5. Lack of adequate environmental input in the form of appropriate nutritional counseling for the ambulatory individual with COPD puts the individual at risk for the development of an elevated total serum cholesterol level and associated health risks.

The use of this nursing theory was appropriate in context of this study. Nursing care is required when there

is disequilibrium in the system. Chronic obstructive pulmonary disease and elevated serum cholesterol levels may, and do, cause system disequilibrium in individuals. The goal of nursing in this case is to facilitate the individuals attempt to regain, maintain, and restore stability and health. Appropriate nursing action would include the use of comprehensive assessment and implementation of research-based nutritional counseling.

Significance to Nursing

Nurses provide care to the population of individuals with COPD. Nursing standards for the care of the respiratory client are in place (Staff, ATS News, 1981; Johanson, Dungca, Hoffmeister, & Wells, 1981; Siskind, 1989). Nursing diagnoses have been developed for clinical practice associated with the care of the pulmonary client suffering from respiratory problems (ATS, 1981; Carpenito, 1989).

In addition, nurses are concerned about the lifestyles of their clients, including those individuals with chronic pulmonary disease. Pulmonary disease is a progressive disease process that results in deterioration of lung function, client lifestyle, and morale. It is also generally recognized as the most common reason for premature disability in adults over the age of 40, making this group of individuals eligible for a lesser annual income payable under the Federal Social Security Disability

Income Act. The social significance of this is that the majority of monies spent through this Act go to individuals requiring early retirement for medical reasons associated with COPD.

Chronic obstructive lung disease has been cited as the fastest growing chronic disease state in America today (Lertzman & Cherniack, 1976; Hodgkin, Zorn, & Connors, 1984; O'Ryan & Burns, 1984; Toevs, Kaplan, & Atkins, 1984; Berman & Sutton, 1986). An increasing number of productive adults under the age of 40 are being placed in a position of trying to maintain their current employment without modification for energy expenditure associated with the work of breathing or accepting lower energy-requiring positions which often pay less, both of which carry the risk of increased absenteeism associated with chronic pulmonary disease, or taking early medical retirement.

Openbrier and Covey (1987) address nutritional needs associated with pulmonary disease. Nutritional depletion alters respiratory function and structure, lung defense mechanisms, and muscle function (Sue, 1989). Nursing goals are aimed at meeting energy needs as well as providing for nutritional support for tissue repair and replacement. These nursing goals are intended to help the client regain optimal respiratory function and resume effective breathing patterns. Nursing interventions are dependent on the individual status of the client (Openbrier & Covey, 1987;

DeLetter, M. C., 1991).

Nurses are in a position to intervene in the area of nutritional therapy and the ramifications of diet for individuals with COPD, whether acute or ambulatory. Pulmonary rehabilitation programs, pulmonary clinics, community trials, etc. are prime areas for conducting further research in dietary management in the ambulatory COPD population. In particular, nurses are in a position to study individuals who consume higher levels of fat in their diet as an intervention aimed at improving lung function and the ramifications for potential problems associated with elevated serum cholesterol levels. More information is necessary regarding the type of diet currently consumed by ambulatory COPD populations as well as the type of diet these individuals should consume for optimizing pulmonary function and maintaining a general state of well health. Findings of this study allow for more appropriate counseling of ambulatory individuals with COPD.

CHAPTER TWO

LITERATURE REVIEW

The purpose of this study was to investigate whether there was a difference in total serum cholesterol level as a function of severity of disease, age, and gender in ambulatory individuals with COPD. A review of the literature specifically discussed the following areas as they pertained to this study: nursing theory, COPD, serum cholesterol, and previous research related to this area of study.

Nursing Theory

Dorothy Johnson's behavioral system model serves as the theoretical basis for this nursing study. The systems construct of this model is based on general systems theory. The system and subsystems of this model function together to achieve equilibrium and effective behavioral functioning. System and subsystem equilibrium reflect constructive adaptation and adjustment (Johnson, 1980). All four domains in nursing are addressed. The individual and nursing are the most completely developed concepts, health and environment are ellusively addressed. The focus of this model is on efficient and effective behavioral functioning.

The individual is defined as a behavioral system that is made up of seven interrelated subsystems. Each subsystem is responsible for carrying out its own

specialized tasks for the system as a whole. The seven subsystems identified are:

1. Attachment-affiliative: behavior that serves the function of security;
2. Dependency: behavior related to attachment issues, that has as its consequence approval, attention or recognition and physical assistance;
3. Achievement: exploratory behavior that attempts to manipulate the environment;
4. Aggressive: behavior that serves to self-protect and preserve;
5. Ingestive: behavior that serves to satisfy the appetite;
6. Eliminative: biologic behavior of excretion of wastes; and
7. Sexual: behavior that serves gender role and to procreate and gratify (Johnson, 1980).

The subsystem of ingestion was the focus for purposes of this study.

The individual, as a behavioral system, is determined by the behaviors and functions exhibited (Johnson, 1974; 1978b; 1980). On the other hand, these behaviors and actions are regulated and controlled by the individual (Johnson, 1968). The actions or behavioral patterns of an individual are efforts to maintain system integrity, equilibrium, and manage the system's relationship to its

environment (Johnson, 1968; 1980).

Nursing is concerned with the behavioral problems of the individual rather than biological functions, though nursing problems may arise in areas of human need including biological needs (Johnson, 1968). Nursing problems, real or possible, are the result of an individual's loss of system integrity or equilibrium or because the behaviors exhibited reflect less than optimal functioning. The goal of nursing action or intervention is to attain, maintain, or restore an individual's behavioral system equilibrium and stability or help a person achieve a more optimal level of functioning with environmental interactions where possible or desirable (Johnson, 1978a; 1978b; 1980). Preventive nursing actions are included within this goal (Johnson, 1980).

Within this framework, nursing is defined as an external regulatory force that assists an individual to achieve equilibrium and stability. Nursing service is needed when there is actual system disequilibrium resulting in an illness or when there is a threat to the individual's social or physical health. The nurse may function to assist the client in achieving optimal behavioral functioning by imposing a variety of external control measures. Attempts to constructively change actual structural units or meet functional requirements of the system may be made by the nurse (Johnson, 1980). One

example of an actual (with the possibility of also being a potential) nursing problem might be decreasing stress and tension, which would ultimately promote adaptation and system stability in an individual. As a result of nursing intervention, the individual will achieve, maintain or restore a degree of stability and equilibrium to functional behavior (Johnson, 1961; 1968; 1974; 1978a; 1978b; 1980; Wallace & Coberg, 1988).

There are references to both internal and external environments within this nursing model, though the environment is not defined. The behavioral system functions to maintain its own integrity and to manage the relationship to its environment. Two inferences might be drawn: 1. that the internal environment deals with maintenance of "its own integrity" and 2. the non-internal environment is the external environment. Either environment may serve as a stimulus that would result in system/subsystem disequilibrium or move the system/subsystem to equilibrium and stability (Johnson, 1980).

Health is another concept not defined, but rather alluded to and described. It is determined by social, psychological, and physiological factors based on a health professional value system (Johnson, 1978a). Johnson (1961) describes health as a moving state of equilibrium which occurs throughout the health change process. Health problems or lack of balance in the system are either

structural or functional. They arise from the system itself or from environmental factors. The five major causes of instability or problems with the system were discussed in Chapter I.

Appropriate nursing action may be taken when proper identification of the source of problems causing disequilibrium in the behavioral system has been identified. Appropriate nursing actions may include: repairing the structural unit through teaching or similar activities, temporarily imposing external regulatory or control measures such as limit setting, and providing essential environmental conditions or resources in various situations (Johnson, 1978b).

COPD

In men over the age of 40, chronic airflow limitation has been documented as the second most common cause of permanent disability (Hodgkin, Balchum, Kass, Glasen, Miller, Hass, Shaw, Kimbel, & Petty, 1975). Brooks & Brawner (1981) said that COPD had become the fastest growing health care problem in the United States. Bronchitis, emphysema, and asthma have been implicated in a 224% increase as cause of death in the past twenty years. McDonald (1981) reports that COPD is the most common disease for which respiratory patients are referred for home care. In 1982, chronic pulmonary disease was the third leading cause of death in the United States.

Respiratory related problems are implicated in 20% of all physician contacts and 12% of all short-term hospitalizations. Estimated direct and indirect costs of these illnesses approximate \$45 billion per year. Respiratory illness ranked sixth among conditions leading to early retirement due to disability (ATS, 1981). Berman & Sutton (1986) reported that chronic respiratory ailments accounted for more than 60,000 deaths per year in the United States and Canada.

Chronic lung diseases, specifically COPD, are a major and potentially crippling group of illnesses (McDonald, 1981). These are chronic diseases for which there are no known cures and treatment is aimed at relief of symptoms and minimizing the effects of the disease on the life of the individual (Davido, 1981). Lertzman & Cherniack (1976) identified one aim of therapy to be prevention of the progression of the underlying disorder.

Mall & Medeiro (1988) believe individuals often lack knowledge of the meaning of COPD, the effect of COPD on pulmonary function, and the methods available to control or manage the disease. Until recently, individuals with COPD were viewed as poor candidates for rehabilitative measures because of the progressive debilitating nature of the disease (Shenkman, 1985). Evidence now indicates that comprehensive respiratory care programs significantly improve an individual's capability to carry out activities

associated with normal, everyday life. Nutritional education has been identified as one important component of such programs. Evaluation of the individuals nutritional status and the out-lining of a dietary prescription based on specific individual needs has been directly addressed (ATS, 1981).

Pulmonary rehabilitation has become recognized as an appropriate treatment modality for the integrated management of individuals suffering from chronic respiratory insufficiency (Lertzman & Cherniack, 1976). These treatment programs have two principal objectives: 1) to control and alleviate as much as possible the symptoms and pathophysiologic complications of respiratory impairment and 2) teach the individual how to carry out their activities of daily living optimally. These objectives are met through education and exercise components (ATS, 1981).

Hunter, Carey, & Larsh (1981) demonstrated that with increasing severity of disease, weight progressively declines. Asmundsson & Kilburn (1969) associated weight loss not only with acute respiratory failure and morbidity, but also with cor pulmonale and high mortality.

The literature addresses nutritional replacement and therapy in the respiratory client who is critically ill (Askanazi, Rosenbaum, & Hyman, 1980; Coveilli, Black, Olsen, & Beekman, 1981; Angelillo, Bedi, Durfee, Dahl, Patterson,

& O'Donohue, 1985; Keim, Luby, Braun, Martin, & Dixon, 1986; Weissman & Hyman, 1987; Schlichtig & Sargent, 1990). Covelli, Black, Olsen, & Beekman (1981) demonstrated that large carbohydrate loads lead to a rise in respiratory quotient (RQ) of >1.0 and increase carbon dioxide production. This is important because it may precipitate respiratory acidosis.

The RQ is the ratio of carbon dioxide production to oxygen consumption. With increased carbon dioxide production there is increased ventilation, which may increase the risk of development of respiratory failure. The RQ for fat oxidation is equal to 0.7, protein 0.8 and carbohydrate (or glucose 1.0). Fat is equal to 8 calories per gram, protein 4 and carbohydrate 4. This makes fat an appropriate nutrient substrate, with a lower oxidation number and higher caloric content (Giovannini, Chiarla, Boldrini, & Castagneto, 1989).

Askanazi, Rosenbaum, & Hyman (1980) believed if the individual was incapable of responding to the increased carbon dioxide production, respiratory failure would result. Appropriate management of these individuals would require a shift from carbohydrate calories to diets with higher fat content. In respiratory failure, nutritional rearrangement of caloric intake would include 30-50% of total nonprotein calories from fat sources (Askanazi, Rosenbaum, & Hyman, 1980; Covelli, Black, Olsen, & Beekman,

1980). Miller (1986) proposed that fat become the diet of choice because of the difficulty encountered with the use of carbohydrates as principal energy sources in respiratory failure.

Reines, Gallagher, Hall, Sahn, Venus, & Wedel (1989) discussed the role of nutrition and weaning from mechanical ventilation. It was interesting to find that T. J. Gallagher, a panelist in the discussion, was the only source found to state an excess of glucose calories (1800 to 2500 calories) was no longer a major concern in weaning the difficult patient from mechanical ventilation.

Serum Cholesterol

Becker & Wilder (1987) demonstrated that fat in the typical American diet accounts for approximately 40% of the daily calories consumed. This includes a significant amount of saturated fat and cholesterol, 15% and 500 mg., respectively. The recommended amount of total fat consumed daily is less than 30%, with less than 300 mg. of cholesterol and less than 10% saturated fat making up this total fat amount (American Heart Association, 1986). The typical American diet has been associated with high levels of blood cholesterol.

Serum cholesterol is a wax-like substance that is a substrate for hormone and bile acid production and is used in the synthesis and repair of membranes. It is the sum of several component parts. High density lipoprotein (HDL) is

programmed to return cholesterol to the liver. An increased HDL is associated with less atherogenesis, which is valued in terms of cardiovascular health and decreased risk for coronary heart disease. Low density lipoprotein (LDL) causes damage to the inside lining of the arterial walls and also increases platelet aggregation. It is thought to be atherogenic. An LDL to HDL ratio of <5 is considered to place an individual at low risk for events associated with coronary heart disease. Very low density lipoproteins (VLDL) are largely composed of triglycerides and contain 10% to 15% of the total serum cholesterol (NCEP, 1988).

The importance of elevated serum cholesterol in the pathogenesis of coronary artery disease has been documented (Shekelle, Shyrock, Paul, Pepper, Stamler, Shuguey, & Raynor, 1981). Lowering elevated total serum cholesterol levels has been associated with the slowing and even arrest of progression of atherosclerosis in populations with and without clinical manifestations of coronary heart disease. In conjunction with a cholesterol lowering diet, the recommendations include increasing carbohydrates from the current 40-50% of caloric intake to 50-55% with an increase in complex rather than simple carbohydrates (Becker & Wilder, 1987).

Recommendations for the evaluation and treatment of hyperlipidemia have been under investigation for some time

(Dawber, 1980; Perry, 1986). Schrott (1987) has stated "genetic, experimental, epidemiological, and clinical interventions studies overwhelmingly support a causal relationship between blood cholesterol level elevations and increased frequency of coronary heart disease" (p. 3-4). Evidence from diet trials strongly support the contention that the lowering of blood cholesterol level and increasing HDL cholesterol decreases the incidence of coronary heart disease and slows the progression of existing disease (Lipid Research Clinic Programs, 1984). Recent mortality statistics released by NCEP and the American Heart Association indicate a decrease in age-adjusted death rates associated with cardiovascular disease over the last ten years that may, in part, be related to a decrease in fat consumption in the American diet (NCEP, 1988; American Heart Association, Iowa Affiliate, 1989).

The National Cholesterol Education Program (1988) identified eight coronary heart disease factors:

1. male gender;
2. family history of premature coronary heart disease (definite myocardial infarction or sudden death before age 55 in a parent or sibling);
3. cigarette smoking (currently smokes more than 10 cigarettes per day);
4. hypertension;
5. HDL-cholesterol concentration (below 35 mg/dL.

confirmed by repeat measurement);

6. diabetes mellitus;

7. history of definite cerebrovascular or occlusive peripheral vascular disease; and

8. severe obesity (equal to or greater than 30% overweight) (NCEP, 1988).

Current blood cholesterol values for selecting adults at moderate and high risk requiring treatment have been identified. Individuals with plasma cholesterol concentrations >200 mg/dL. are at risk for the development of coronary artery disease (Rifkind & Segal, 1983). Levels between 200-239 mg/dL indicate borderline-high blood cholesterol and those equal to or greater than 240 indicate high blood cholesterol. Individuals with a total serum cholesterol level in the borderline group without definite coronary heart disease or two other risk factors need dietary information and a yearly measure of total cholesterol. Those with borderline-high or high levels who also have two other coronary risk factors, or have coronary disease need further lipoprotein analysis (Becker, Larosa, & Watson, 1989).

It has been shown that dietary modification is the first and primary treatment modality for individuals with elevated total serum cholesterol levels. It is especially important to reduce total fat calories, thereby reducing serum cholesterol level, in order to effect a decrease in

the risks associated with coronary heart disease (Becker, Larosa, & Watson, 1989).

Previous Research in COPD and Total Serum Cholesterol Level

Available research specific to serum lipids and lung disease is limited. Nonkin, Dick, & Baum (1964) reported there was a lower incidence for myocardial infarction in individuals with COPD. They believed this was related to the fact that these individuals were frequently underweight. The literature reviewed in the area of lipid study for this thesis proposal did not take weight into consideration.

Jeffreys, Leessoof, & Mattock (1980) were able to show an elevation in total serum cholesterol along with a large decrease in HDL in females receiving prednisolone therapy for asthma over a period of approximately three years. This study indicated that high levels of corticosteroids may increase the risk of ischaemic heart disease in pre-menopausal women. Total serum cholesterol was measured in a convenience sample of sixteen pre-menopausal women (age range 18-34) and fifteen males (age range 24-38) who were all receiving long-term corticosteroid treatment for pulmonary problems. All were in remission at the time of the study. Participants receiving treatment were age, sex, and disease matched against those not receiving corticosteroids and healthy age and sex matched controls.

Tisi, Conrique, Barrett-Connor, & Gundy (1981)

demonstrated that individuals with emphysema had much higher levels of HDL than their controls by matched pair analysis ($p < 0.02$). Their basis for clinical matching included physiologic criteria for classification as predominantly emphysema. They determined levels of HDL and compared HDL levels to healthy matched controls similar in age, obesity, index, alcohol use, smoking history, and race. They postulated that the increased HDL may be attributed to the increased work of breathing that emphysematics experience and perhaps from the effects of drugs. A Spearman rank-ordered correlations of pulmonary function test with HDL showed there was no correlation between the loss in pulmonary function and the level of HDL. Their convenience sample of 29 came from the Chest Clinic of the Veterans Administration Medical Center, San Diego, California.

Lehtonen, Viikari, Sallinen, & Elo (1982) conducted a study to evaluate the effects of beta 2-adrenergic stimulation on serum lipids. After three months of use of salbutamol (albuterol) they were able to show slightly higher levels of total serum cholesterol and LDL, but the differences were not statistically significant. Serum HDL and triglycerides remained constant. This study involved a convenience sample of thirteen subjects with mild bronchial asthma.

Wadehra, Chhabr, Gaur, Joshi, & Agrawal (1987)

conducted a study on abnormalities in lipid metabolism in men and women with asthma and rhinitis compared with healthy individuals. Though their research did not address total serum cholesterol, they were able to demonstrate higher HDL levels, the type responsible for protecting one from the development of atherosclerotic processes. Unfortunately, the sample size for each of the three gender groups studied, except asthmatic men (32) were less than nineteen for either sex. Their convenience sample was chosen from a group of individuals who attended an outpatient clinical research center. To date, the study has not been replicated.

Bolton, Mulloy, Harvey, Downs, & Hartog (1989) demonstrated significantly higher HDL in individuals with COPD. These subjects were using inhaled or nebulized beta-2 agonist therapy, oral theophyllines, or oral or inhaled steroids. Though utilizing control subject/match design, a convenience sample selection process was used with eighteen subjects participating. The same age group was studied using identical methods and controls. Body mass index, non-smokers, and no clinical evidence of respiratory disease or being on drugs in healthy individuals was matched against the diseased subjects. This study has not been replicated.

Summary

The literature reviewed indicated that an elevated

total serum cholesterol level was an important health risk to consider in the diets of individuals, including those ambulatory individuals with COPD. Johnson's Behavioral system model is an appropriate theoretical basis for this study. Johnson's domain concepts reflect one way nurses may focus their use of the nursing process to address client needs, including dietary management for ambulatory individuals with COPD. Information from the literature review supported the idea that higher fat consumption in any individual's diet may lead to an elevated total serum cholesterol level. The implication for health concerns in the area of coronary heart disease associated with elevated total serum cholesterol level has been documented. It is not unrealistic to expect the same conclusion to be drawn to those who are ambulatory individuals with COPD.

Unfortunately, there was little information available on appropriate nutritional counseling for ambulatory individuals with COPD reviewed for this particular study. Information from the literature review indicated that appropriate and accepted nutritional support of the critically ill pulmonary client focuses on maintaining an adequate RQ, caloric intake, and balance. Higher fat ingestion is prescribed in diets of these critically ill individuals. Little information has been available on the use of higher fat diets and possible implications associated with an elevated total serum cholesterol level

in ambulatory individuals with COPD.

A deficiency in the literature review was identified. Individuals with lung disease who may be required to ingest diets higher in fat because of their disease may have their health and well-being compromised. The literature does not adequately address whether or not they may be at risk for developing health problems associated with elevated total serum cholesterol levels. Researchers and health care providers may be overlooking the significance of elevated total serum cholesterol levels in this group of individuals in order to meet their nutritional needs without jeopardizing their pulmonary function. It has been identified that there is a need for maintenance of adequate nutrition in ambulatory individuals with COPD. There is the known association of increased coronary artery disease and cardiovascular disease with elevated total serum cholesterol levels. It was because of the lack of research in this area that this research study was done.

CHAPTER III

METHODOLOGY

The purpose of this study was to investigate whether there was a difference in total serum cholesterol level as a function of severity of disease, age, and gender in ambulatory individuals with COPD.

Approach

An ex post facto study design was used since data collected were retrospective in nature (Borg & Gall, 1983). The focus of this research was to identify variables that were non-manipulative in nature, i.e., serum cholesterol, severity of lung disease, age, and gender and then determine differences in groups. Additional data regarding smoking history were also collected. Data were gathered through an audit of medical records of those individuals who had participated in a pulmonary rehabilitation program from 1986 through 1989. Information was gathered about total serum cholesterol level, the degree of severity of disease, age, and gender in ambulatory individuals with COPD. Medical records from all subjects in this purposive sample were reviewed.

Sample

The medical records of those persons who had participated in a pulmonary rehabilitation program between 1986-1989 were reviewed for the following criteria.

1. A medical diagnosis of COPD by a physician;

2. Participation in a comprehensive pulmonary rehabilitation program at a midwestern medical center; and
3. Completion of all admission criteria of the program at the same institution (see Appendix A for a description of the methodology for calibration of equipment used in Pulmonary Function Tests (PFTs) and laboratory procurement and analysis of serum samples).

A total of 80 medical records were available for review in the medical records department of the medical center. However, 19 medical records were eliminated because diagnostic and laboratory testing was completed at a hospital or health care facility other than the hospital defined in the study criteria or because data were missing. An additional 15 medical records were unavailable for evaluation for data collection at the study hospital. The remaining 46 medical records were evaluated for data and the data were entered into the sample. The age and gender of the subjects is shown in Table 1 found on page 32.

Table 1 on page 32 represents the demographic data on age and gender. Age was broken into 15 year categories based on the age range of the sample without consideration for gender. Gender was obviously self-explanatory. The highest number of subjects fell in the 66-75 age category, accounting for 39% of the sample. The lowest percentage of the sample fell in the 76-85 age category. Females

accounted for 52% of the sample, while the males represented the remaining 48%.

Table 1

<u>Age and Gender</u>		
<u>Age</u>		
40-55	8	17%
56-65	16	35%
66-75	18	39%
76-85	4	9%
<u>Gender</u>		
Male	22	48%
Female	24	52%

Procedure

Approval for the study was obtained from the Human Subjects Research Review Committees at both Drake University and the midwestern medical center where the pulmonary rehabilitation program was offered. Direct consent from persons whose records were reviewed was not needed as consent for participation in the pulmonary rehabilitation program addressed the use of information from medical records for the purpose of research. A copy of the consent for participation in the pulmonary rehabilitation program is included (see Appendix B).

The subjects' charts were reviewed in the medical records office at the midwestern medical center.

Data related to total serum cholesterol level, degree of severity of lung disease, age, gender, and smoking history were collected using the form found in Appendix C.

Findings from the medical record review were reported in group form. Identities of the subjects were not disclosed.

Cholesterol was categorized according to the American Heart Association's (AHA) recommended levels: low <200 , middle $200-239$, and high ≥ 240 . Pulmonary function was categorized according to the Intermountain Thoracic Society guidelines: normal >0.69 , mild $0.61-0.69$, moderate $0.45-0.60$, and severe <0.45 .

CHAPTER IV

RESULTS

The purpose of this study was to investigate whether there was a difference in total serum cholesterol level as a function of severity of disease, age, and gender in ambulatory individuals with COPD. The categorization of subjects by cholesterol and severity of lung disease is shown in Table 2.

Table 2

<u>Cholesterol and Severity of Disease</u>			
		<u>N</u>	<u>% of Sample</u>
<u>Cholesterol Level</u>			
low	<200 mg/dl	11	24%
middle	200-239 mg/dl	22	48%
high	>240 mg/dl	13	28%
<u>Severity of Disease</u>			
normal	>0.69	5	11%
mild	0.61-0.69	6	13%
moderate	0.45-0.60	14	30%
severe	<0.45	21	46%

Forty-eight percent of the sample had serum cholesterol levels in the middle range, 200-239 mg/dl. Twenty-four percent of the sample accounted for cholesterol levels <200 mg/dl. The largest number of subjects (46%) in the severity of disease group was the severe disease

category, the smallest (11%) was the normal category.

Three hypotheses were tested in this study. Findings related to each hypothesis follow.

Hypothesis One

Hypothesis one stated that: There will be a difference in total serum cholesterol level when the sample is categorized by severity of disease. There was no significant difference in total serum cholesterol level when categorized by severity of disease, see Table 3. Table 4, on page 36, represents results from the Analysis of Variance for this data, $F(3,44)=0.23$, $p=0.8778$. Hypothesis one was not supported.

Table 3

Comparison of Serum Cholesterol Level and Severity of Disease

<u>Severity</u>	<u>N</u>	<u>Mean Cholesterol</u>	<u>S. D.</u>
normal	5	213.00 mg/dl	48.69
mild	6	228.33 mg/dl	59.40
moderate	14	225.35 mg/dl	26.40
severe	21	231.81 mg/dl	53.32

Hypothesis Two

Hypothesis two stated that: There will be a difference in total serum cholesterol level when the sample is categorized by age. No significant difference in total serum cholesterol when the sample was categorized by age

was found, see Table 5. Table 6 on page 37 represents results from the Analysis of the Variance, $F(3,44) = 1.26$, $p = 0.3006$. Hypothesis two was not supported.

Table 4
Analysis of Variance of Serum Cholesterol Level
and Severity of Disease

Source of Variance	df	Sum of Squares	Mean Squares	F Ratio	p Level
Within Groups	42	93449.79	502.88	0.23	0.8778
Between Groups	3	1508.65	2224.99		

Table 5
Comparison of Serum Cholesterol Level and Age

Age Group	N	Mean Cholesterol	S. D.
40-55	8	233.25 mg/dl	34.40
56-65	16	241.25 mg/dl	58.77
66-75	18	211.67 mg/dl	35.40
76-85	4	230.50 mg/dl	43.68

Hypothesis Three

Hypothesis three stated that: There will be a difference in total serum cholesterol level when the sample is categorized by gender. There was no significant difference in mean cholesterol level when the sample was

categorized by gender, $t(44) = 0.7717$, $p = 0.44$ (see Table 7, page 37). Hypothesis three was not supported.

Table 6
Analysis of Variance of Serum Cholesterol Level
and Age

Source of		Sum of	Mean	F	p
Variance	df	Squares	Squares	Ratio	Level
Within					
Groups	42	87121.50	2074.32	1.26	0.3006
Between	3	7836.93	2612.31		
Groups					

Table 7
Comparison of Serum Cholesterol Level and Gender

Gender	N	Mean Cholesterol	S. D.
Male	22	221.86	51.59
Female	24	232.38	40.53

Additional Findings: Smoking History

Of the 46 charts reviewed, 45 had smoking histories available. Two men and 3 women had incomplete smoking histories in terms of length in years they had smoked. The entire sample had quit smoking prior to participation in the pulmonary rehabilitation program. Table 8 on page 38 represents smoking histories of subjects for whom it was available.

Of the 46 subjects, a total of 38 had smoking histories that averaged 1.45 packs per day (PPD) and 33 had smoked for an average of 37.85 years. Seventeen of the 24 women smoked. The females smoked an average of 1.49 PPD with an average of 37.79 years for the 14 whose histories were available. Twenty-one of 22 men smoked. The males smoked an average of 1.42 PPD with an average of 37.89 years. Based on the findings, females in the sample smoked slightly more than the males did for a shorter period of time.

Table 8

<u>Smoking Histories</u>			
	<u>Males</u>		<u>Females</u>
<u>Smoked</u>	21 (96%)		17 (71%)
<u>Did not smoke</u>	1 unknown (4%)		7 (29%)
<u>Packs/Day (PPD)</u>			
≥ 3	1		1
≥ 2	5		6
≥ 1	14		7
< 1	1		3
<u>Years Smoked</u>			
≥ 50	5		
40-49	4		6
30-39	8		8
20-29	1		
< 20	1		

The range in years for the females smoking was 30-47 with a range in packs per day of less than 1 to more than 3. The range in years for the males smoking was 15-51 with a range in packs per day of less than 1 to more than three. Interestingly, both groups clustered around 1-2 packs per day smoked which is consistent with the current national average for cigarette consumption in the United States.

CHAPTER V

DISCUSSION

The purpose of this study was to investigate whether there was a difference in total serum cholesterol level as a function of severity of disease, age, and gender in ambulatory individuals with COPD. Statistical analysis did not support the three hypotheses.

There was no significant difference in total serum cholesterol when the sample was categorized by severity of disease. The findings reveal 46% of the sample (severe category) had a mean total serum cholesterol level of 232 mg/dl, the highest mean in the severity of disease category, while 11% (normal category) had a mean total serum cholesterol level of 213 mg/dl, the lowest in the category.

Perhaps the lack of significant difference is attributable to the small number of subjects represented in both the serum cholesterol level and severity of disease categories. It was also unknown whether or not the subjects consumed a diet high in fat as a medically prescribed therapeutic modality. It is also possible that if subjects had been encouraged to consume diets higher in fat, with some consuming more and others less, that a difference in in the amount of fat consumed may have in part accounted for the lack of significant difference. Perhaps smoking influenced both severity of disease and

cholesterol levels. It is also possible that the work of breathing experienced by the subjects with lung disease served as an aerobic exercise that produced a cholesterol lowering effect (Tisi, Conrique, Barret-Connor, & Grundy, 1981).

There was no significant difference in total serum cholesterol level when the sample was categorized by age. Serum cholesterol levels in the sample did not reflect those found in the general population. Mean serum cholesterol levels in the general population are found to be significantly higher in each age category until age 45-54 in men and 55-64 in women with levels plateauing at about age 50 except in older women. Levels declined with advancing age after 55-64 in both genders (Fulwood, Kalsbeek, Rifkind, Russell-Briefel, Muesing, LaRosa, & Lippel, 1986, NCEP, 1988). The 40-55 age group in the sample, which was not gender-age-specific, demonstrated an elevated mean total serum cholesterol level of 233 mg/dl. However, 44% of the sample (age groups of 56-65 and 76-85) demonstrated the highest (241 mg/dl) and third highest (231 mg/dl), respectively, mean total serum cholesterol levels. Thirty-nine percent (66-75 age group) of the sample reflected a decrease in mean total serum cholesterol level (212 mg/dl). In spite of this, there was no significant difference between the age categories. Again, smoking history and consumption of fat in the diet may have had

more of a role than age alone.

There was no significant difference in total serum cholesterol level when the sample was categorized by gender. Though the mean total serum cholesterol levels for each gender in the sample were higher than those stated for the general population, there was a similarity in the elevation pattern. The overall mean serum cholesterol levels in the general population for men and women aged 20-74 were found to be 211 and 215 mg/dl, respectively (Fulwood, Kalsbeek, Rifkind, Russell-Briefel, Muesing, LaRosa, & Lippel, 1986). Females accounted for 52% of the sample and had the higher mean total serum cholesterol level, 232 mg/dl, in spite of the fact that there was no significant difference between the genders. Males (48% of the sample) had a mean total serum cholesterol level of 222 mg/dl. Once again, smoking history and consumption of fat in the diet may have contributed to the variance in the findings versus gender alone.

Additional findings related to smoking history revealed that females smoked for a shorter period of time and slightly more than the males did. How this variable may have affected study results was not a parameter for the study. Though the sample had quit smoking previous to entry in the pulmonary rehabilitation program from which data were collected, there was a history of smoking for 83% of the sample. Perhaps previous smoking history played a

larger role in the development of either elevated total serum cholesterol level or severity of disease or both.

Though no significant differences were established in the study, mean total serum cholesterol levels across each category evaluated were elevated above the suggested level of ≤ 200 mg/dl set by the American Heart Association. Perhaps the sample was no different than the general population when considering the risk for the development of coronary heart disease (NCEP, 1988). A number of additional risk factors were identified as strongly associated with the development of coronary heart disease (NIH Consensus Conference, 1985). It was not possible to control for these additional variables during the study. Therefore, the following were not parameters of the study: chronic conditions such as hypertension, obesity, diabetes mellitus, peripheral vascular disease, genetic components, inactivity, low HDL concentration, and behavior patterns. Any one or a combination of these variables may have affected the findings of elevated mean total serum cholesterol levels across the categorizations of the study.

Relationship to the Theoretical Model

Dorothy Johnson's Behavioral System Model served as the theoretical basis for this nursing study. Her model identified 5 major causes of instability or problems within the system, though all 5 may not have been substantiated by the study.

Perhaps the ingestion of a diet higher in fat in ambulatory individuals with COPD may contribute to the inappropriate development of hyperlipidemia in the system (individual). Elevated mean total serum cholesterol levels were consistent across the areas of categorization in the study. Had data regarding fat consumption in the diet been collected, results might have indicated that ambulatory individuals with COPD were at an approximate risk for the development of elevated total serum cholesterol levels as was the general population. The findings of the study indicate there are elevated total serum cholesterol levels. These individuals may be at increased risk for the same health problems associated with elevated total serum cholesterol levels as is the general population. An example of the inappropriate development of the system's parts in this case might be the occlusion of coronary vessels.

The literature reviewed supports the idea that ingestion of diets higher in fat contribute to the breakdown of internal regulatory or control mechanisms that are physiologically in place for the management of plasma cholesterol levels. Though complete diet histories were not obtained and analysed, total serum cholesterol levels available for data analysis demonstrated consistently elevated mean total serum cholesterol levels. Perhaps this might indicate that there was a breakdown in cholesterol

homeostasis for some reason, whether related to severity of lung disease, age, gender, or some other variable not addressed in the study.

The consistently elevated mean total serum cholesterol levels across study categories may indicate that the subjects experienced an exposure to a noxious influence. Perhaps severity of disease, age, gender, or other noxious influences, such as smoking or the other variables previously discussed, did occur in such a manner as to create a noxious situation to which the system responded by increasing the total serum cholesterol level.

Lack of adequate environmental input in the form of appropriate nutritional counseling for ambulatory individuals with COPD exists. Because of the lack of adequate research in this area, generalizations about nutrition for individuals with acute respiratory problems have been applied to individuals with COPD. Despite the fact that diet histories were not reviewed, consistently elevated total serum cholesterol levels found in the study indicate that there was a need to consider evaluation of nutrition for the sample especially in light of current dietary treatment for individuals with elevated total serum cholesterol levels and COPD.

Implications for Nursing

The results of the study revealed no significant difference in total serum cholesterol level as a function

of severity of disease, age, and gender in ambulatory individuals with COPD. However, mean total serum cholesterol levels were elevated in 76% of the sample. Caution must be exercised in assuming that these differences do not exist in other populations. Therefore, the professional nurse may want to consider this fact when caring for ambulatory individuals with COPD. Professional nurses should include assessment of serum cholesterol levels in ambulatory individuals with COPD. While there was no significant difference in total serum cholesterol level when compared to severity of disease, age, or gender, nurses must be aware of the relationship of a diet high in fat and the development of elevated total serum cholesterol levels although for some clients, this may be the medically prescribed therapeutic diet. In addition, risk factors for the development of coronary heart disease should be considered in light of the changing demographics of COPD and generally accepted dietary management.

As a result of the consistently elevated mean total serum cholesterol levels, it is apparent that nurses need to have more comprehensive dietary protocols available to use with their clients. Nurses need to be involved in research aimed at defining appropriate nutritional management for ambulatory individuals with COPD. Instead of merely counseling ambulatory individuals with COPD about good, balanced nutrition and dietary supplementation with

fats in increasingly severe disease states, nurses must be able to plan appropriate nutritional intake collaboratively with the client and other health care providers.

The implication for this approach requires nurses to take an active role in research that identifies actual nutritional needs of individuals with COPD. It would be important to focus on energy requirements with activity level and the respiratory quotient. Because COPD is being diagnosed more frequently and, more importantly, at an earlier age, consideration of elevated total serum cholesterol level would be another focus issue since the review of literature consistently supports diets higher in fat as a therapeutic modality for ambulatory individuals with COPD. In addition, literature speaks to the risk associated with diets higher in fat and that first line therapy for hyperlipidemia is reduction in fat consumption. If fat must be the nutritional substrate, monitoring cholesterol levels over time on the high fat diets becomes imperative so that dietary changes may be instituted to lower serum cholesterol to 200 mg/dl or less. Additional research must be conducted in the area of what type of fat these individuals should eat (perhaps increased polyunsaturated fat), in what amount, how it can be made pleasing to the individual, and at what financial expense to the client (DeLetter, M. C., 1991). Nurses could then use these findings in their diet teaching.

There is also an implication for nursing regarding the role smoking plays in the development of elevated serum cholesterol and severity of lung disease. Though it is not a new idea, there is a need for professional nurses to be more involved in preventive health care in the area of smoking and its relationship to the development of hyperlipidemia and lung disease. Eighty-six percent of the sample had smoking histories, more females than males smoked and for slightly longer. In addition, females had the higher mean total serum cholesterol level. It is therefore reasonable that nurses continue to support client's efforts at smoking cessation. There are a number of things that are available for client participation that nurses could facilitate either on a referral basis or personally: smoking cessation classes, individual counseling for smoking cessation, and education regarding the use of medication aimed at assisting one to quit smoking. Nurses must be more willing to actively assist those clients who are interested in self-help approaches to smoking cessation. Awareness of the number of commercial or non-profit organizations, such as those offered by the American Lung Association, American Heart Association, or American Cancer Association and their cost, is another way nurses could assist individuals with their efforts at smoking cessation.

There were no significant differences found in this

study when comparing total serum cholesterol in gender. Review of the literature reveals that older women have higher serum cholesterol levels. Perhaps this is normal for women and warrants no further concern. Perhaps norming serum cholesterol levels in older women should be considered if higher serum cholesterol levels are "normal" in this particular age-gender group. However, if the American Heart Association and various other researchers have determined that there is a relationship between elevated serum cholesterol level and the risk for development of coronary heart disease, perhaps nurses should be concerned. Again, mean total serum cholesterol levels for each category researched in this study were elevated >200 mg/dl, with female subjects having the higher total serum cholesterol level than the male subjects.

Limitations of this Study

There were several limitations in the study. The sample was small and one of convenience. Had the sample size been larger, a significant difference may have been computed because of a larger variance in total serum cholesterol levels and severity of lung disease ranges. In addition, other variables may have influenced total serum cholesterol level and severity of disease that were not part of the study. There was no interaction with the subjects themselves. There were a total of 80 participants in the pulmonary rehabilitation program between 1986 and

1989. Certain numbers were not available because medical diagnostics (PFTs and serum laboratory values) were not completed at the medical center where the program was completed. In addition, 15 medical records were not available for review.

Recommendations for Further Research

There are a number of related areas that need to be researched. This study could be replicated investigating the interrelationship among smoking history, exercise history, severity of disease, chronic disease states that may affect total serum cholesterol level, HDL/LDL cholesterol ratio, the genetic component, and behavior patterns. Pulmonary rehabilitation programs exist across the United States. Professional nurses in these programs are in prime positions to replicate this study. These studies would need to have an increased sample size within each category studied. Enlarging the sampling population could occur if clientele were identified in pulmonary medicine practice offices where professional nurses work. Ambulatory individuals with COPD could be "matched" with pulmonary rehabilitation program participants to determine if there was a difference between the two populations.

Summary

Current dietary management for individuals with COPD includes the need for 40-50% of the caloric intake to come from fats. This approach provides higher caloric density

per gram of substrate with a lower respiratory quotient. This in turn provides the individual with more calories at a lesser cost in terms of energy required for respiration as a result of metabolism. Review of the literature, however, reveals that diets higher in fat, particularly saturated fat, place individuals at risk for the development of elevated total serum cholesterol levels that may in turn cause risk for the development of coronary heart disease. Little research was reviewed that addressed the incidence or associated risk for ambulatory individuals with COPD for elevated total serum cholesterol levels because of diet therapy. Though diet histories were not part of the research design, the elevated mean total serum cholesterol levels in the categories studied do pose questions related to the risk for developing other health problems associated with elevated serum cholesterol levels.

The purpose of this study was to investigate whether there was a difference in total serum cholesterol level as a function of severity of disease, age, and gender in ambulatory individuals with COPD.

Forty-six medical records of persons with COPD who participated in a pulmonary rehabilitation program between the years of 1986-1989 at a midwestern medical center were reviewed. Data related to total serum cholesterol level, severity of disease, age, gender, and smoking history were collected.

Statistical analysis of the data revealed no significant difference in total serum cholesterol level when the sample was categorized by severity of disease, age, or gender. Total serum cholesterol levels ranged from 140-362 mg/dl. However, mean total serum cholesterol levels were elevated >200 mg/dl in all categories studied and 76% of the sample had elevated total serum cholesterol levels. Additional findings related to smoking history revealed that 83% of the sample had previous smoking histories. As well, female subjects smoked slightly more than the males did and for a longer period of time.

Nurses are in a position to assist ambulatory individuals with COPD to a higher level of wellness through use of the nursing process, research, and preventive health measures. Dorothy Johnson's Behavioral System Model served as the theoretical basis for this nursing study. Her model supported the study even though there were no significant differences found within the purpose and hypotheses as stated.

Review of the literature indicates that there is a valid relationship between elevated serum cholesterol level and risk factors for the development of coronary heart disease and other health problems. This study seems to suggest that there may be reason for concern for ambulatory individuals with COPD who may be counseled to consume a diet higher in fat. Further research in this area may

demonstrate that preventive measures are an important aspect of care for the ambulatory individual with COPD.

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APPENDICES

APPENDIX A
Methodology for PFTs/Laboratory

Pulmonary Function Testing at Medical Center is performed by one of 3 Registered Respiratory Therapists trained for pulmonary function testing. This greatly decreases the incidence of operator error and variation. The tests are performed on a Gould 1000 IV A computerized pulmonary function laboratory.

Prior to each patient, a self-calibration is performed to ensure proper calibration of inspiratory and expiratory flow sensors. The patient's age, height, weight, sex, and race, as well as room temperature and barometric pressure are entered into the computer. Knudson Standards are used to determine the patient's predicted (normal) values.

To ensure consistency, pulmonary function tests are performed the same for all patients. Spirometry testing consists of three tests:

1. Lung subdivisions: the patient is instructed to tidal breathe for at least 5 breaths, then slowly exhale as far as possible. When the computer shows no flow, the patient is instructed to inhale as deep as possible. This test gives tidal volume (Vt), expiratory reserve volume (ERV), and slow vital capacity (SVC). This test is repeated at least once to verify patient effort and reliability. Therefore, 2 SVC's must be $\pm 5\%$ of each other.
2. Flow-volume loop: this maneuver is performed by having the patient tidal breathe, then inhale maximally. At this point the patient is instructed to blow the air out of their lungs as hard and fast as possible. When no flow is seen, the patient is told to inhale as fast and deep as possible. This test gives many values, the most important being forced vital capacity (FVC), forced expiratory volume in 1 second (FEV 1), mid flow rates (FEF 25-75%), peak expiratory flow (PEF), and forced inspiratory vital capacity (FIVC). This test, according to the Intermountain Thoracic Society (ITS) and the American Thoracic Society (ATS) standards must be performed so that at least 3 tests (the sum of FVC and FEV 1) are within 5% of one another.
3. Maximum voluntary ventilation (MVV): for this test the patient breathes fast and deep for 10, 12, or 15 seconds. The volume is then extrapolated out for a minute for a 1 minute value (ie. 12 seconds $\times 6 = 1$ minute). This value is estimated to be approximately 35 times the FEV 1. If not, the patient's effort may be poor and the test should be repeated. However, conditions such as bronchospasm and muscle weakness must not be overlooked.

November 14, 1989

Evelyn Schnoor, R.N.
Cardiopulmonary Rehabilitation Department
1215 Pleasant Street
Des Moines, Iowa 50309

Dear Evelyn:

This letter is in response to your questions concerning our methods used for cholesterol testing on Chemistry-12 and Chemistry-18 profiles. The method that we are currently using is a cholesterol oxidase and cholesterol esterase method. The cholesterol esterase enzyme hydrolyzes the cholesterol esters and then the cholesterol oxidase enzyme oxidizes the cholesterol to produce hydrogen peroxide. The peroxide is used by horseradish peroxidase to oxidize a dye precursor to produce a color. The intensity of the color is proportional to the cholesterol concentration. Currently this determination is performed on an instrument called the Perspective, produced by American Monitor Corporation. We have checked this method against another automated method we use in the Laboratory which itself is referenced to the CDC reference method for cholesterol analyses. This assures us that we are producing results which can be compared to the reference method.

The method that we used prior to December 1988 was similar to the current one in that it was also an oxidase/esterase system. However, the instrument was quite different, and we used a SMAC II prior to December 1988. This instrument is made by Technicon Instrument Company, and we used it from about May of 1984 through November 1988. We calibrated the cholesterol channel on that system against another instrument in the Laboratory which itself had been referenced against the CDC reference method for cholesterol. Thus, again, we attempted to have our cholesterol analyses as close to the reference method as we could.

I hope that these explanations have been sufficient for your needs. Should you have questions or desire additional information, please feel free to call me at the Laboratory at .

Sincerely,

A handwritten signature in cursive script, appearing to read "Richard Snyder".

Richard Snyder, Ph.D.
Clinical Chemist

APPENDIX B
Consent Form

1. EXPLANATION OF OUT-PATIENT REHABILITATION PROGRAM

You will be placed on a rehabilitation program that will include physical exercise. You will be given explicit instructions regarding the amount and kind of regular exercise you should do. Organized exercise sessions will be adjusted by the nurse or physical therapist in consultation with the physician depending on your progress. You will be given the opportunity for re-evaluation with a graded exercise test _____ months after the initiation of the rehabilitation program. Other retests may be recommended as needed.

2. MONITORING

Your blood pressure will be monitored as required. You will monitor your own pulse rate before, during, and after each exercise session. In addition, ECG monitoring of your exercise prescription will be performed if necessary. Ear oximetry will also be utilized as necessary.

3. RISKS AND DISCOMFORTS

There exists the possibility of certain changes occurring during the exercise sessions. These include abnormal blood pressure, fainting, disorders of heart beat, and increased work of breathing. Every effort will be made to minimize them by the preliminary examination and by observations during exercise. Emergency equipment and trained personnel are available to help with unusual situations which may arise.

4. BENEFITS TO BE EXPECTED

The results obtained may help in evaluating in what types of activities you might engage safely in your daily life. No assurance can be given that the rehabilitation program will increase your functional capacity although widespread experience indicates that improvement is usually achieved.

5. RESPONSIBILITY OF THE PARTICIPANT

To gain expected benefits you must give priority to regular attendance and adherence to prescribed amounts of intensity, duration, frequency, progression, and type of activity.

To achieve the best possible preventive health care:

DO: Report any unusual symptom which you experience before, during, or after exercise, or you notice in an exercising colleague.

DO NOT: A. Withhold any information pertinent to symptoms from the rehabilitation professionals.
B. Exceed target heart rate.
C. Exercise when you do not feel well.
D. Exercise within two hours after eating.
E. Exercise after drinking alcoholic beverages.
F. Use extremely hot shower after exercising.
G. Undertake isometric or straining exercises.

6. USE OF MEDICAL RECORDS

The information which is obtained during exercise testing and while you are a participant in the Pulmonary Rehabilitation program will be treated as privileged and confidential. This information is not to be released or revealed to any person except your referring physician without your written consent. The information obtained however, may be used for statistical analysis or scientific purpose with the right to privacy retained.

7. INQUIRIES

Any questions about the rehabilitation program are welcome. IF you have doubts or questions, please ask us for further explanation.

8. FREEDOM OF CONSENT

Your permission to engage in this Rehabilitation Program is voluntary. You are free to deny consent if you so desire, both now and at any point in the program.

I acknowledge that I have read this form in its entirety or it has been read to me and that I understand the Rehabilitation Program in which I will be engaged. I accept the rules and regulations set forth. I consent to participate in this Rehabilitation Program.

Signature of Patient

Date

APPENDIX C
Data Collection Form

Data Collection Form

Subject	Total Serum	Severity of	Age	Gender	Smoking
#	Cholesterol	Disease			History
	Level				
<hr/>					

(1-46)